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# Fault Detection Monitoring Controlling of Induction Motor Using Zigbee

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**ABSTRACT:** Induction motor is an alternating current electric motor that is commonly utilized industrial and commercial plants worldwide. It is reported that almost 80% of motors used in industry for the transformation of electrical energy to mechanical energy are induction motors because of their economical, small size, ruggedness, reliability, low maintenance and operation cost. Induction motors are the primary workhorse used as industrial prime movers. Even though these induction motors are very reliable, they are exposed to environmental, duty and installation problems which make these motors subjected to various types of failures shortening the designed lifespan of motors. If detection of motor faults is not done at the early stage of development, it will contribute to the declination of performance and eventual failure of the motors may occur. Several traditional approaches have been taken to sustain the induction motors in good operating condition. One of them is the use of fixed time interval maintenance performed by maintenance engineers taking opportunity of slower production cycle to inspect and rectify the machinery.

**KEYWORDS:**(INDUCTION MOTOR,ZIGBEE,AURDINO,SENSORS)

### I.INTRODUCTION

Fault detection and classification of electrical motors is important in order to avoid unpredicted breakdown of electrical motors. The inherent failures due to unavoidable electrical stresses in motors results in motors experiencing stator faults, rotor faults and unbalanced voltage faults. If these faults are not identified in the early stage, it may become unsuccessful to the operation of the motor. In this paper, the detection and classification of induction motor faults due to electrical related failure using Motor Current Signature Analysis (MCSA).Data collection of current signal of motors with different fault conditions is carried out by using laboratory experiments.

### II. LITERATURE SURVEY

Single Phase and Three Phase Induction machines are very popular in industries because of their vast applications. Hence it becomes necessary to protect them against faults so as to ensure uninterrupted operation and functioning<sup>1</sup>. Various parameter controlling and monitoring systems are there for other types of machine, but in case of induction machine the controlling and monitoring systems are not extensively used due to high cost of installation and physical constraints. So as to overcome the limitations in monitoring and controlling, Zigbee Based System is used which makes it costeffective and simple on the other hand<sup>2</sup>. To start with, first we should know what Zigbee Protocol is. Zigbee is a wireless communication device like Bluetooth and Wireless Local Area Network (WLAN)<sup>3</sup>



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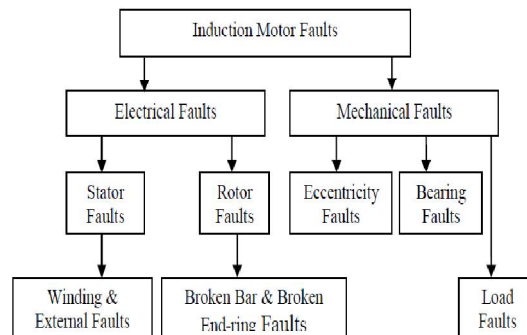
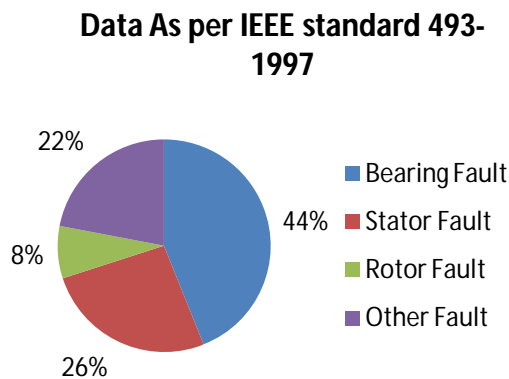
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## III. FAULTS IN INDUCTION MOTOR

Different faults of induction motors are generally classified as either electrical or mechanical faults. Different types of faults include stator winding faults, rotor bar breakage, misalignment, static and/or dynamic air-gap irregularities and bearing gearbox failures. The most common fault types of these rotating devices have always been related to the machine shaft or rotor. The percentage failure components of induction motor are as shown in figure.



The major faults of induction machines can broadly be classified as follows

- (i) Stator faults resulting in the opening or shorting of one or more of a stator phase winding;
- (ii) Abnormal connection of the stator windings;
- (iii) Broken rotor bar or cracked rotor end rings;
- (iv) Static and dynamic air gap irregularities;
- (v) Bent shaft;
- (vi) Shorted rotor field winding;
- (vii) Bearing & gearbox failures;



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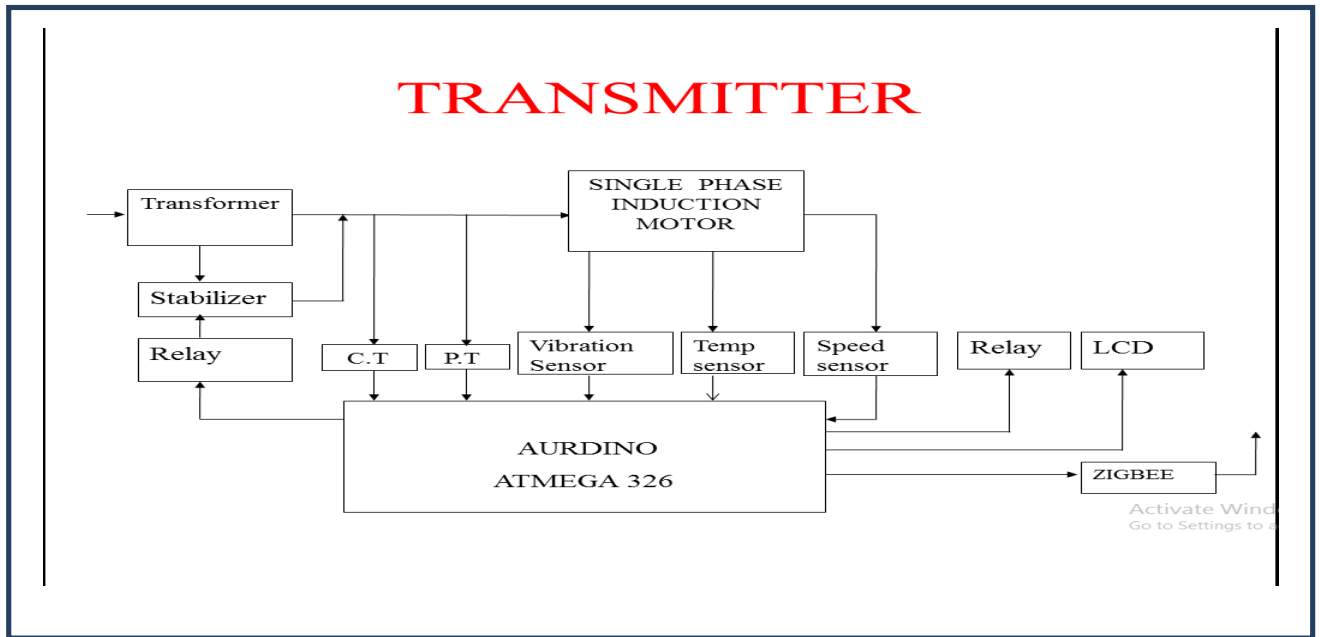
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## IV.BLOCK DIAGRAM



The whole system is divided into two parts transmitter and receiver. In the transmitter part a network of sensor and transducers are used to monitor the risky parameters such as voltage, current, temperature of stator winding and speed of the induction machine .The monitoring data is simultaneously fed to the microcontroller.



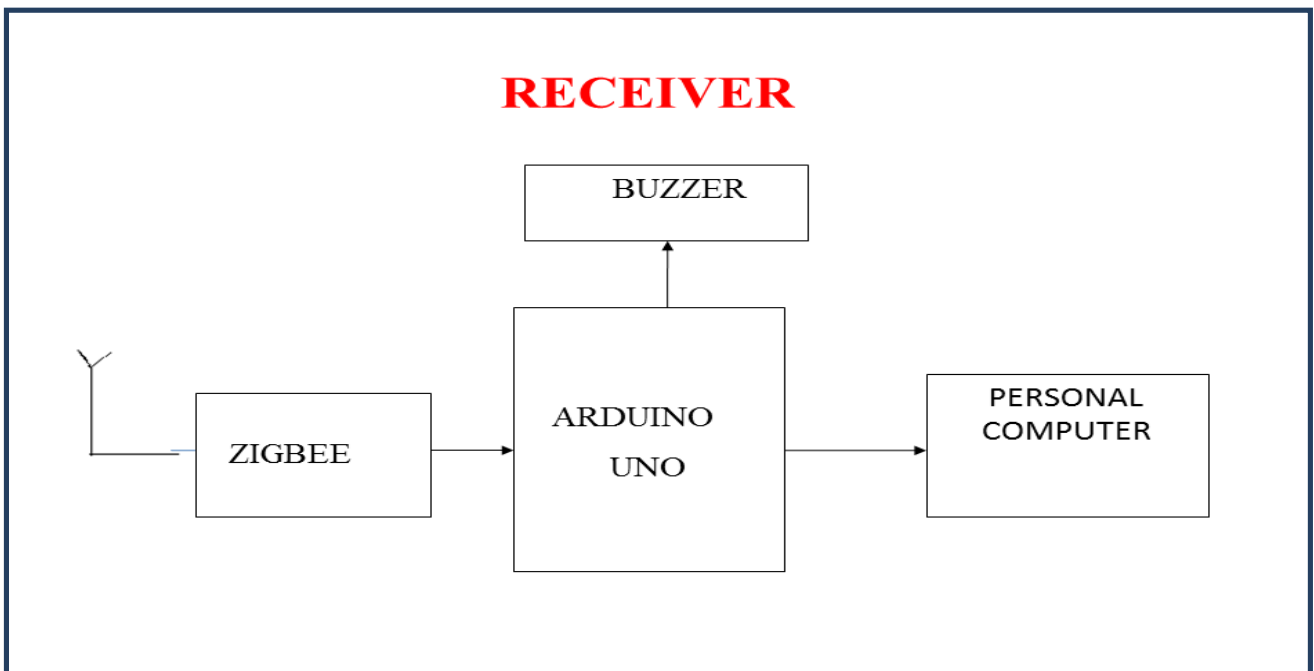
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This data is transmitted efficiently and smoothly to receiver end through wireless Zigbee Communication Protocol (IEEE802.15.4 Standards). The micro-controller at the transmitter end is so programmed that if the monitoring parameters of induction machine come out of the desired or safety limit, a signal will be generated by the micro controller which will energize the relay circuit and the contactor cuts the mains supply to the induction machine. The data received at the receiver end is transferred to computer system through MAX232 interface. Thus a continuous monitoring of the parameters of induction machine can be done from a remote location far away from the actual working location

## V.HARDWARE DESCRIPTION

- Single phase Induction Motor
- Sensors

1)Temperature sensor- LM35(  $2^{\circ}\text{C}$  to  $148.89^{\circ}\text{C}$ )

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

2)Speed sensor - (TLE4941plusC)

The Hall Effect sensor IC TLE4941plusC is designed to provide information about rotational speed to modern vehicle dynamics control systems and Anti-Lock Braking Systems (ABS). The output has been designed as a two wire current interface. The sensor operates without external components and combines a fast power-up time with a low cut-off frequency.

3)Vibration sensor-SKU-DFRR0057

The DF Robot Vibration Sensor buffers a piezoelectric transducer that responds to strain changes by generating a measurable output voltage change which is proportional with the strength of vibration.



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- C.T

The **Current Transformer ( C.T. )**, is a type of “instrument transformer” that is designed to produce an alternating current in its secondary winding which is proportional to the current being measured in its primary.

- P.T

A **voltage transformer theory** or **potential transformer theory** is just like a theory of general purpose step down transformer. Primary of this transformer is connected across the phase and ground. Just like the transformer used for stepping down purpose, potential transformer i.e. PT has lower turns winding at its secondary. The system voltage is applied across the terminals of primary winding of that transformer, and then proportionate secondary voltage appears across the secondary terminals of the PT.

- ARDUINO -ATMEGA326
- Zigbee (IEEE Based 802.15.4,Rang1.5 km)
- Software requirement

### Visual Basic Programming (VB)

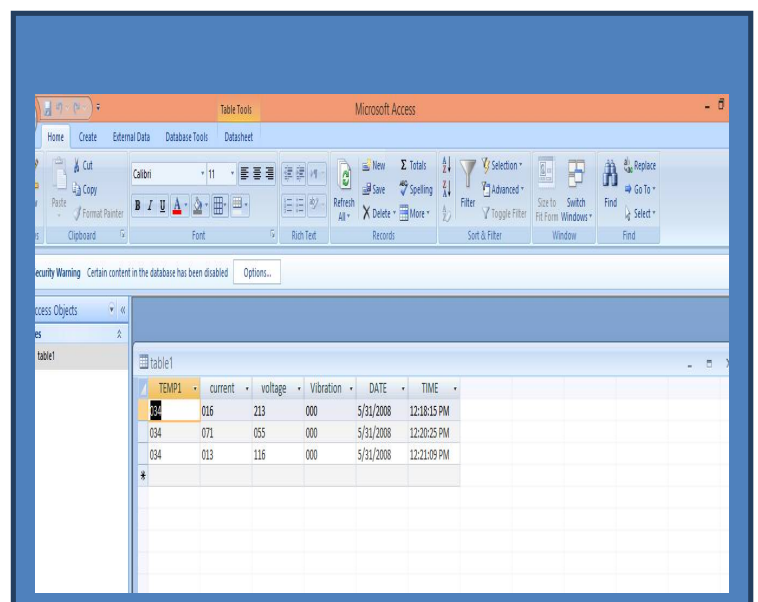
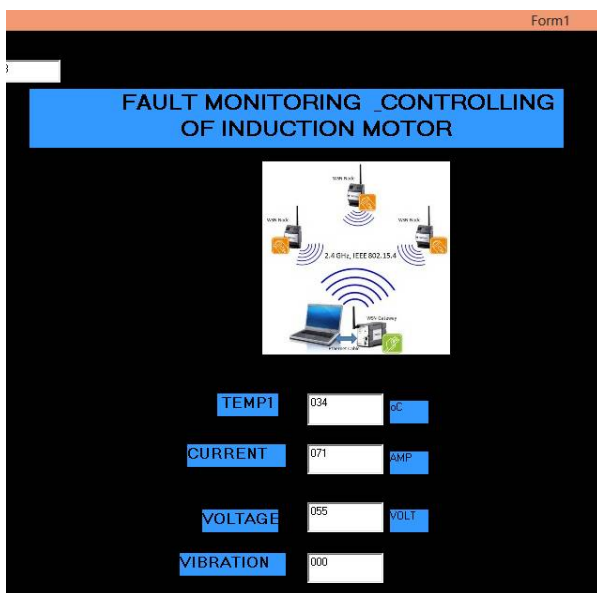
It's a computer programming system developed and owned by Microsoft. Visual Basic was one of the first systems that made it practical to write programs for the Windows operating system. This was possible because VB included software tools to automatically create the detailed programming required by Windows.

It's used over C++ and JAVA because we can represent it has graphically and coding is simpler as compared to other language.

## VI.RESULT

In result we continuously monitor the all parameter of induction motor like temperature, current, voltage and vibration level. Also we save the monitoring data time to time in data base report sheet.

In bellows figure we see the visual monitoring and data report sheet.





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## VII.ADVANTAGES

- Monitoring of an IM is a fast emerging technology for the detection of initial faults.
- It avoids unexpected failure of an industrial process.
- No need to human interference.

ZIGBEE based parameter monitoring system cost of system reduces, efficiency and sensitivity of the system increases as compare to traditional system

## VIII.APPLICATION

- ZIGBEE based wireless sensor network (WSN) for the online speed and vibration monitoring in induction motors.
- It is basically used to control physical parameter like current , voltage, temperature in industries.

## IX.CONCLUSION

In this way a parameter monitoring system for induction motor using Zigbee protocol is realized and tested. It is capable of performing some operations like running the motor through measuring, stopping it, monitoring and controlling all the parameters of the induction motor such as phase voltages, phase currents, winding temperature, speed. All parameter values are transferred to the controlling computer and by using GUI all these parameter values are displayed on the monitor graphically and stored into excel file for a long time monitoring

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